AP1604

PWM/PFM Dual Mode Step-down DC/DC Converter

■ Features

- Input voltage range: 2.2V~5.5V (V_{OUT} type)
- Oscillator frequency: 600KHz (Typ.)
- Internal reference: 1.0V (Typ.)
- High efficiency: 93% (Typ .)
- Stand-by capability: I_{STB}=2μA. (Typ.)
- Soft-start time set-up externally type possible
- Current limit and thermal shutdown protection
- **Pb-Free** Package: SOT23-5, SON-6(3×3×0.8mm)

■ Applications

- Electronic Information Organizers
- Palmtops
- Cellular and portable phones
- Portable Audio Systems
- Various Multi-function Power Supplies

■ General Descriptions

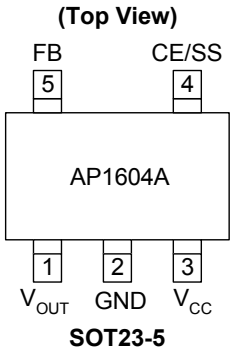
The AP1604 series are multi-functional step-down DC/DC converters with built-in speed, low ON resistance drivers. It is capable to deliver more than 800mA output current with external coil, diode and capacitor.

Output voltage is set-up by the external resistors. (± 2.5% accuracy). The 600KHz AP1604 that can work out with small value external components comes out more compact board.

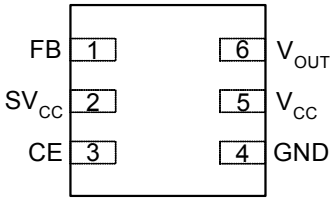
The device switches to and works under PFM mode with light loads. It keeps at high efficiency for both light loads and large output current.

AP1604 can be soft-start with a proper capacitor connected between CE/SS pin and ground. The stand-by current is less than 2uA when CE/SS pin is at “LOW” status. The device is forced to switch off as the voltage at that pin is lower than the stipulated voltage.

■ Pin Assignment



SOT23-5



SON-6

■ Pin Descriptions

Pin Name	Function
V_{OUT}	Output Voltage
V_{CC}	Input Supply
GND	Ground
CE/SS	Chip Enable / Soft Start
FB	Feedback pin
SV_{CC}	Signal Power for SON only

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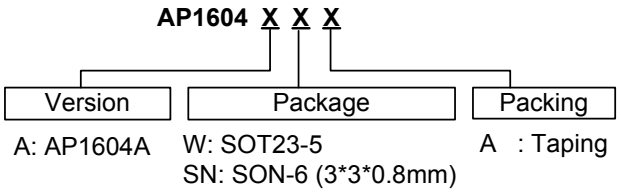
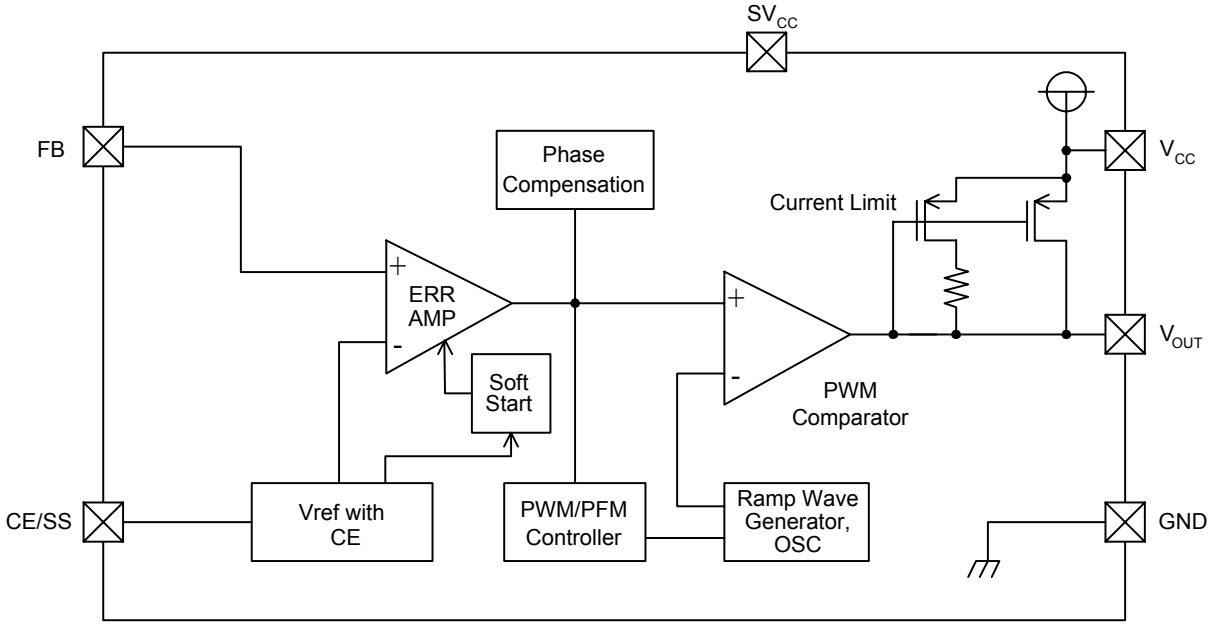
Ordering Information



Block Diagrams



Absolute Maximum Ratings

Ta=25°C

Symbol	Parameter	Ratings	Units
V_{CC}/SV_{CC}	V_{IN} Pin Voltage	-0.3 ~ 6.5	V
V_{OUT}	V_{OUT} Pin Voltage	-0.3 ~ V_{IN}+0.3	V
V_{FB}	FB Pin Voltage	-0.3 ~ V_{IN}+0.3	V
$V_{CE/SS}$	CE/SS Pin Voltage	-0.3 ~ V_{IN}+0.3	V
Pd	Continuous Total Power Dissipation	Internal limited	
Topr	Operating Ambient Temperature	-25 ~ +80	°C
Tstg	Storage Temperature	-40 ~ +125	°C

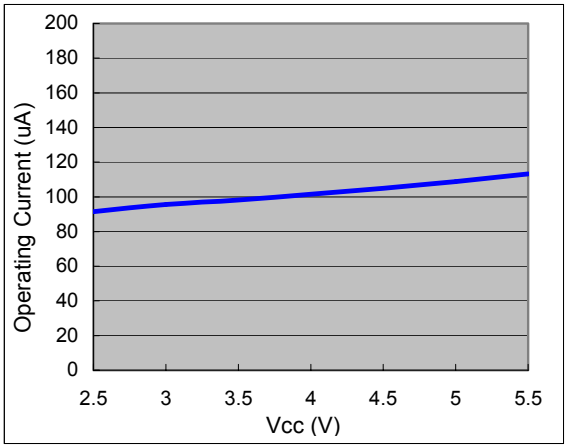
■ Electrical Characteristics

V_{IN}=5V, V_{OUT}＝2V, Load=300mA, Ta=25°C

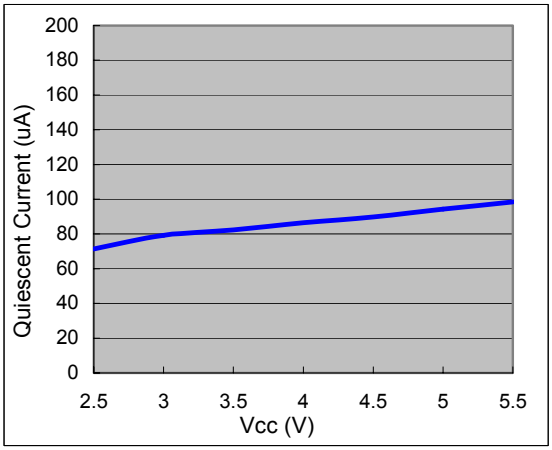
Sym.	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{FB}	FB		0.975	1.0	1.025	V
V_{IN}	Input Voltage		2.2	-	5.5	V
	Line Regulation	V_{IN}=2.2~5.5V, Load=10mA	-	-	0.12	%
	Load Regulation	I_{OUT}=10~800mA	-	-	1.2	%
V_{UVLO}	UVLO Voltage（min. operating voltage）	V_{CC}, voltage required to maintain H at V_{OUT}	-	-	2	V
I_{CC}	Operating Current	CE/SS=V_{IN}, No Load	-	100	150	μA
I_{CCQ}	Supply Current	No external components, CE/SS=V_{IN}, V_{FB}=1.2V	-	90	120	μA
I_{STB}	Stand-by Current	No external components, CE/SS=0V, V_{FB}=0V	-	2	-	μA
I_{CL}	Current Limit	peak current V_{IN}=5V, V_{OUT}=2V	800	1000	1200	mA
Fosc	Oscillator Frequency	Load=300mA, V_{IN}=5V, V_{OUT}=2V	500	600	700	kHz
MAXDTY	Maximum Duty Ratio		85	90	-	%
PFMDTY	PFM Duty Ratio	No load	15	25	35	%
V_{CEH}	CE/SS ”High” Voltage	Apply 1.4V (min.) to CE/SS, determine V_{OUT} ”High”	1.4	-	-	V
V_{CEL}	CE/SS ”Low” Voltage	Same as V_{CEH}, determine V_{OUT}/”Low”	-	-	0.6	V
EFFI	Efficiency	V_{CC}=5V, V_{OUT}=3.3V, Load=300mA	-	93	-	%
Rdson	Rdson Condition	I_{OUT}=300mA, V_{IN}=5V, V_{OUT}=2V	-	350	450	mΩ

■ Typical Performance Characteristics

Vcc v.s. Operating Current

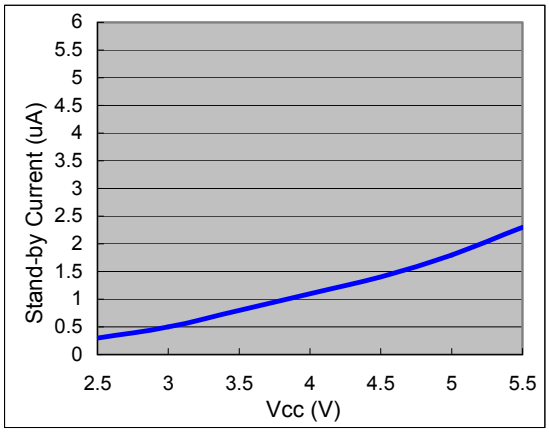


Vcc v.s. Quiescent Current

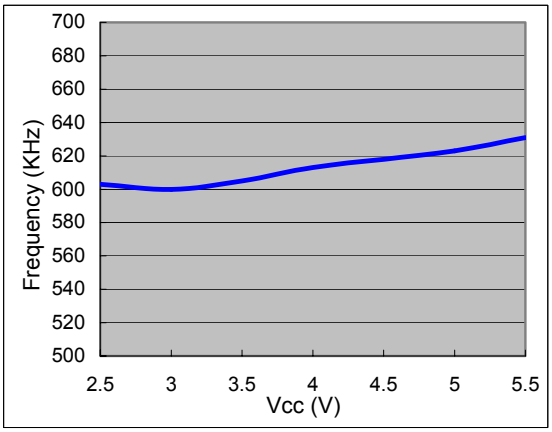


■ Typical Performance Characteristics (Continued)

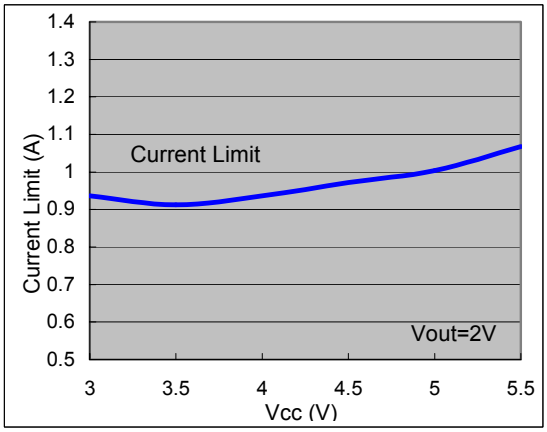
Vcc v.s. Stand-by Current



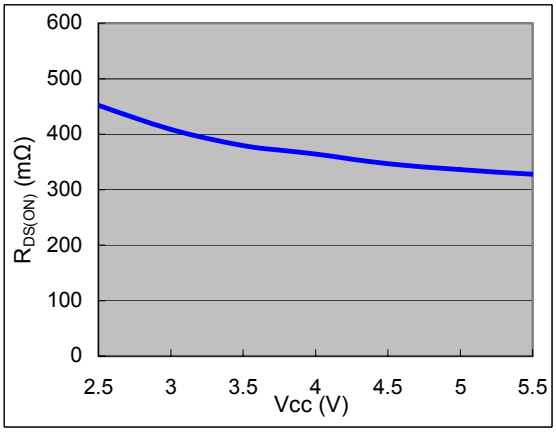
Vcc v.s. Frequency



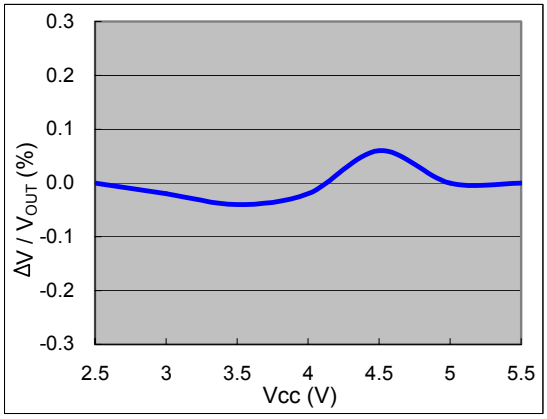
Vcc v.s. Current Limit



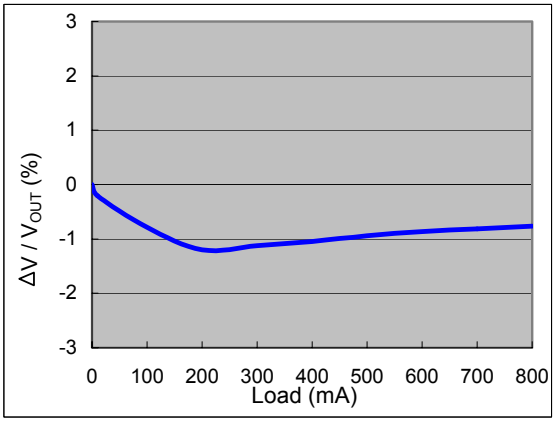
Vcc v.s. $R_{DS(ON)}$



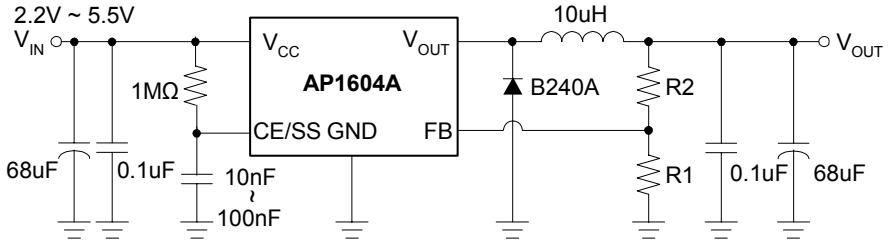
Line Regulation



Load Regulation



■ Typical Application Circuit

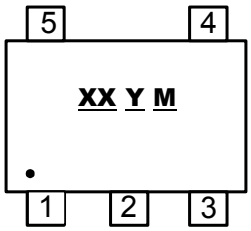


$$Vout = 1 \times (1 + \frac{R2}{R1})$$

R1=100K ~ 200K

■ Marking Information

(1) SOT23-5L



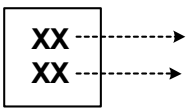
SOT23-5L

XX : Identification code
(See Appendix)
Y : Year: 0-9
M : Month: A~L

Appendix

Part Number	Package	Identification Code
AP1604A	SOT23-5	ER

(2) SON-6L (3*3*0.8mm)



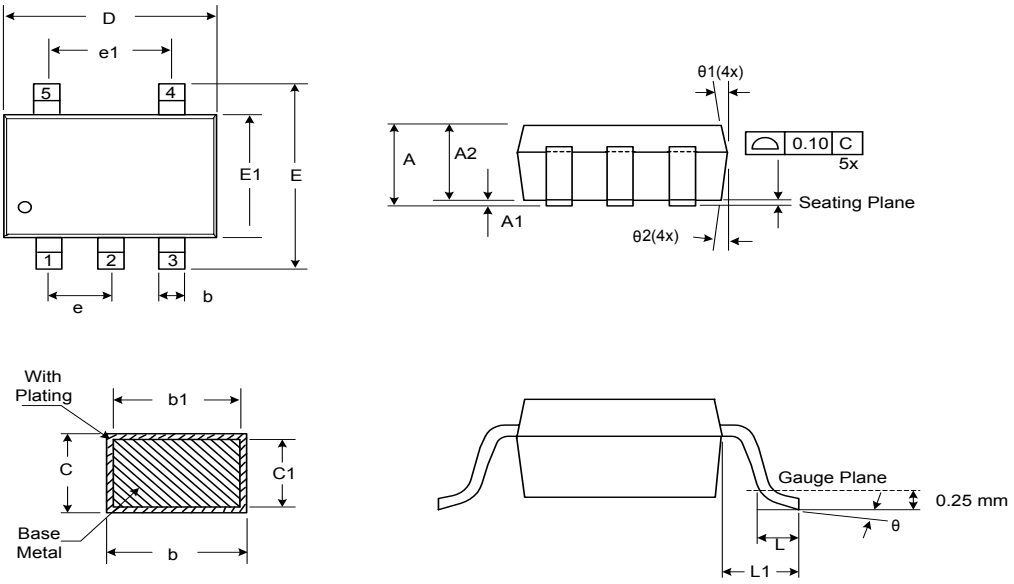
Identification Code
(See the table)
Date Code
Year: 0~9
Month: A~L

Appendix

Part Number	Package	Identification code
AP1604A	SON-6L (3*3*0.8mm)	S4

■ Package Information

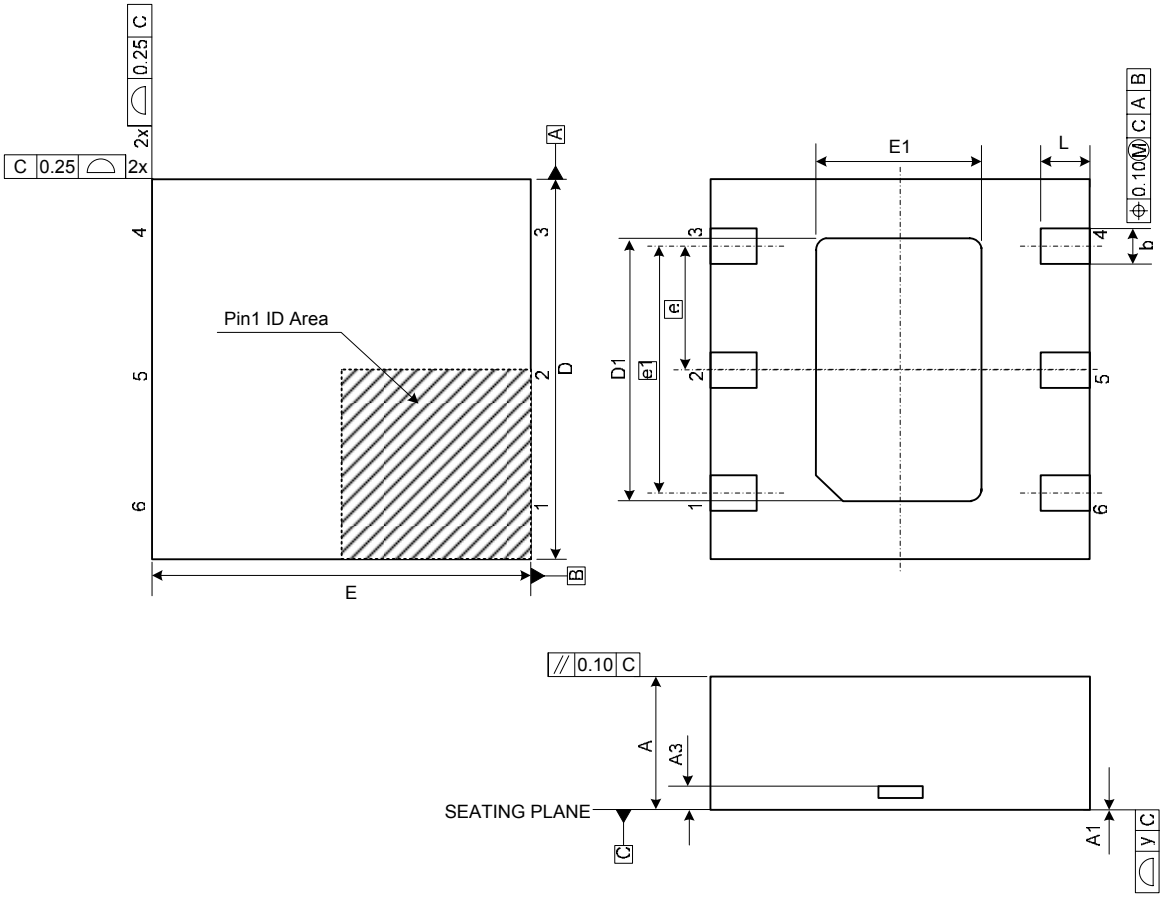
(1) Package Type: SOT23-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	1.20	1.35	0.041	0.047	0.053
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.25	-	0.55	0.010	-	0.022
b1	0.25	0.40	0.45	0.010	0.016	0.018
c	0.08	-	0.20	0.003	-	0.008
c1	0.08	0.11	0.15	0.003	0.004	0.006
D	2.70	2.85	3.00	0.106	0.112	0.118
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
L	0.35	0.45	0.55	0.014	0.018	0.022
L1	0.60 Ref.			0.024 Ref.		
e	0.95 Bsc.			0.037 Bsc.		
e1	1.90 Bsc.			0.075 Bsc.		
θ	0^o	5^o	10^o	0^o	5^o	10^o
θ 1	3^o	5^o	7^o	3^o	5^o	7^o
θ 2	6^o	8^o	10^o	6^o	8^o	10^o

■ Package Information (Continued)

(2) SON-6L (3×3×0.8mm)



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.203 REF.			0.008 REF		
b	0.30	0.40	0.45	0.012	0.016	0.018
D	2.90	3.00	3.10	0.114	0.118	0.122
D1	1.90	2.10	2.30	0.075	0.083	0.091
E	2.90	3.00	3.10	0.114	0.118	0.122
E1	1.30	1.50	1.70	0.051	0.059	0.067
L	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC.			0.037 BSC.		
e1	1.90 BSC.			0.075 BSC.		
y	0.00	-	0.08	0.000	-	0.003

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